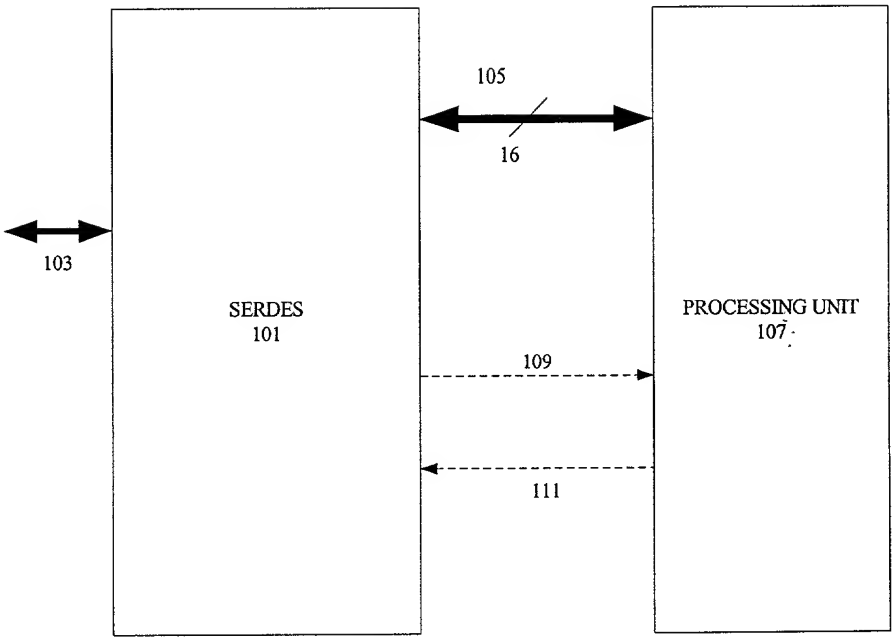


FIG. 1

PTO/SB/21 (09-04)

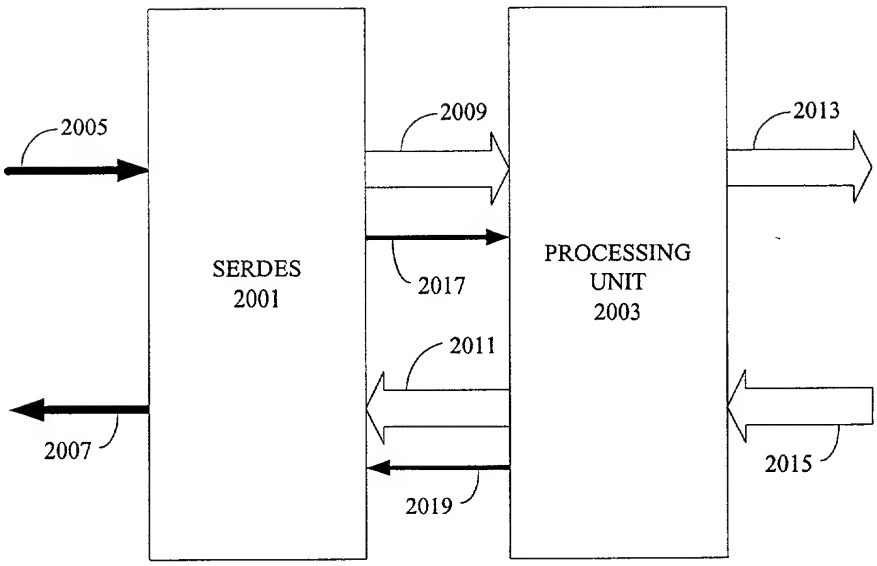


FIG. 2

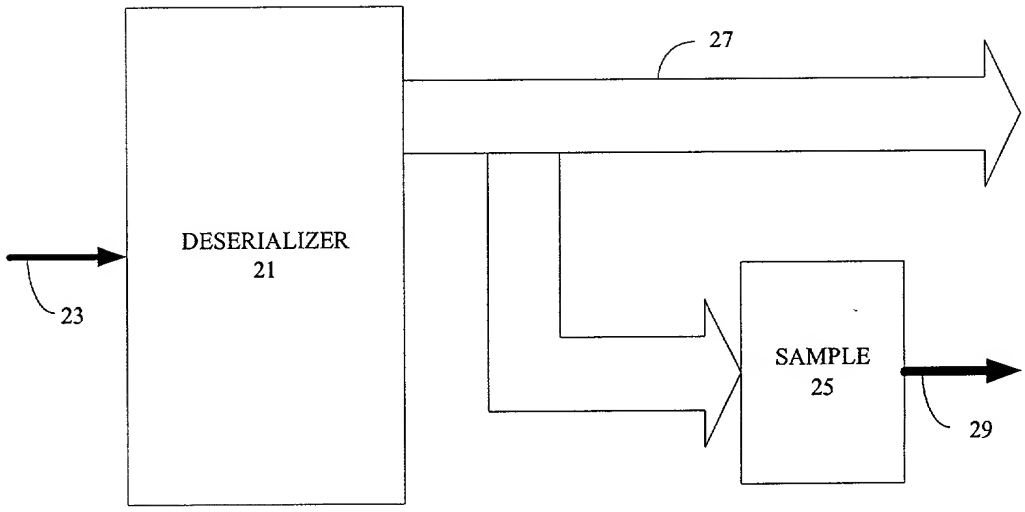


FIG. 3A

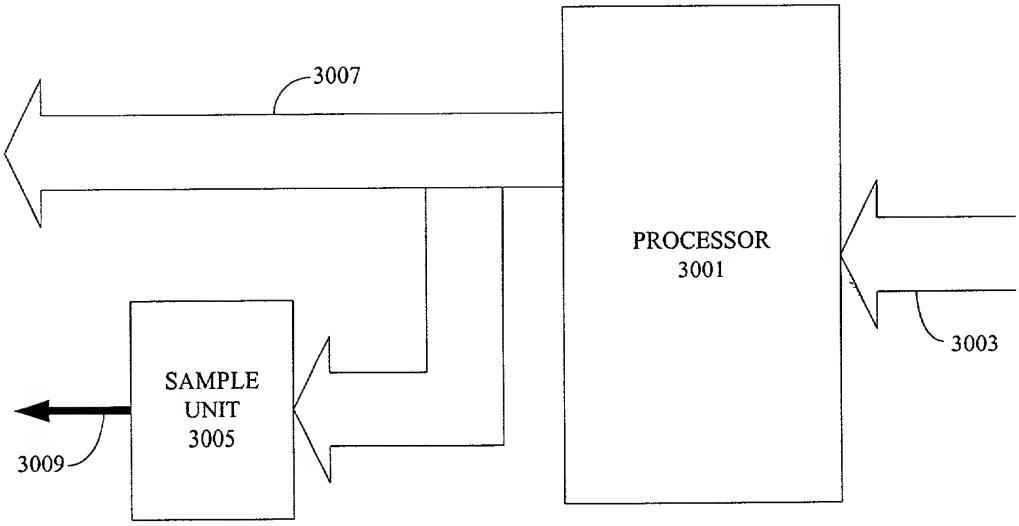


FIG. 3B

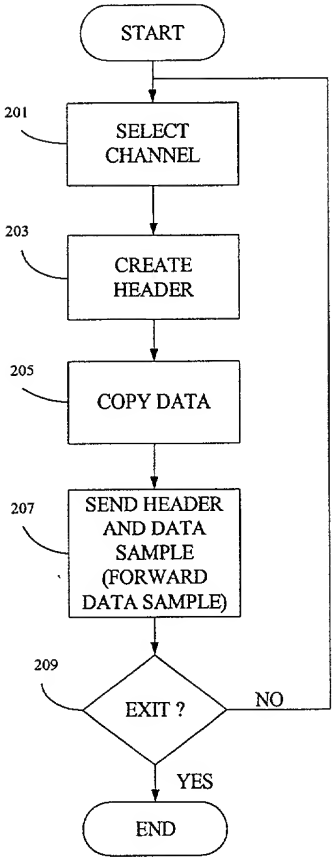
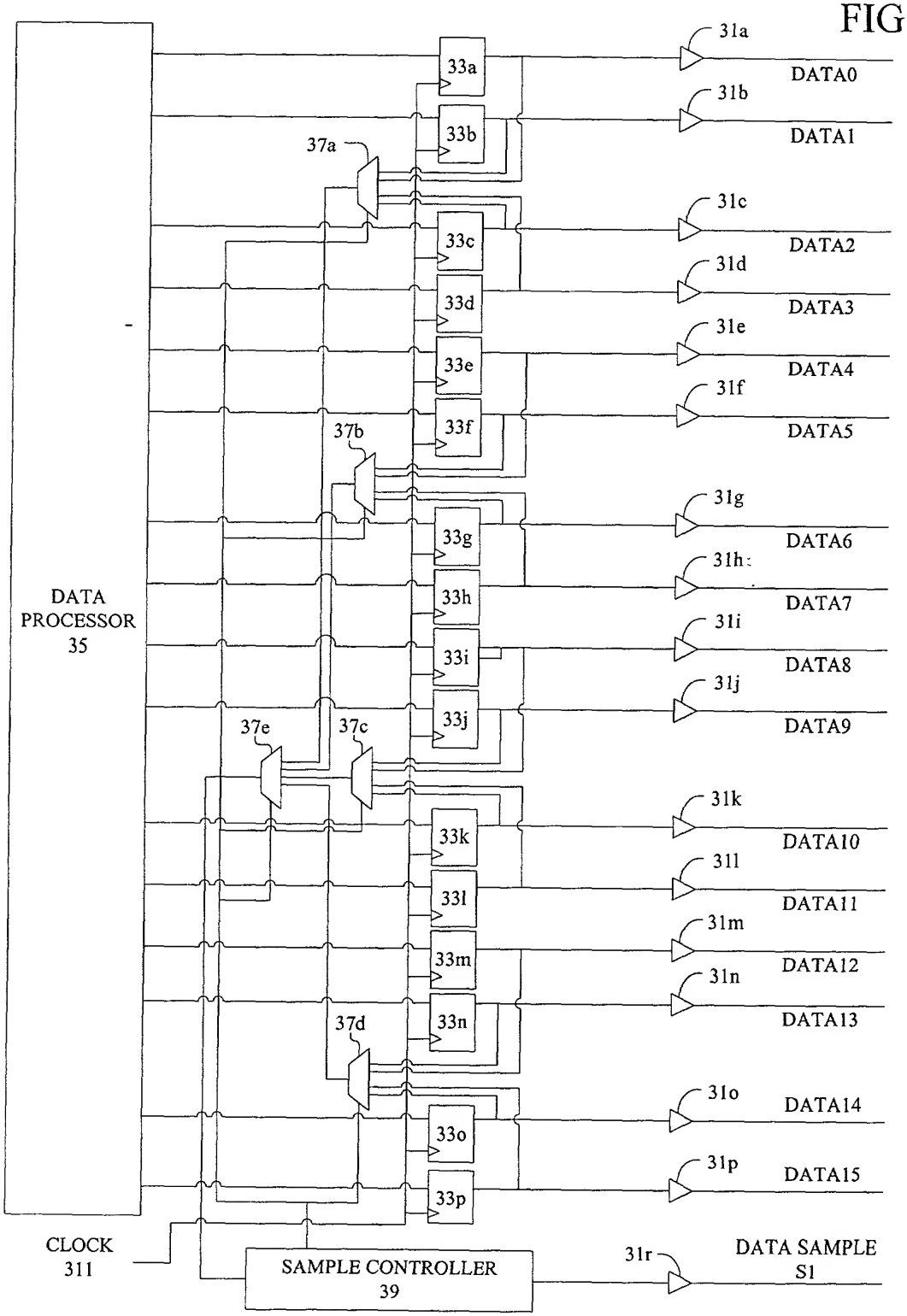

START
201
SELECT CHANNEL
203
CREATE HEADER
205
COPY DATA
207
SEND HEADER AND DATA SAMPLE (FORWARD DATA SAMPLE)
209
EXIT ?
NO
YES
END

FIG. 4

FIG. 5


DATA PROCESSOR 35
CLOCK 311
SAMPLE CONTROLLER 39
DATA SAMPLE S1
31a
DATA0
31b
DATA1
31c
DATA2
31d
DATA3
31e
DATA4
31f
DATA5
31g
DATA6
31h
DATA7
31i
DATA8
31j
DATA9
31k
DATA10
31l
DATA11
31m
DATA12
31n
DATA13
31o
DATA14
31p
DATA15
31r
33a
33b
33c
33d
33e
33f
33g
33h
33i
33j
33k
33l
33m
33n
33o
33p
37a
37b
37c
37d
37e

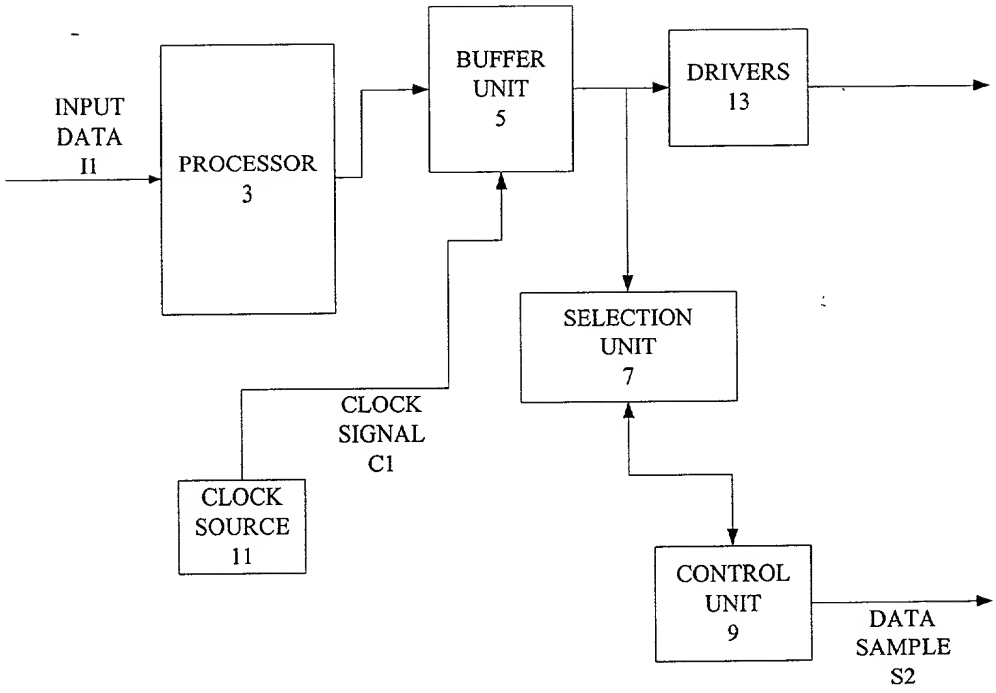
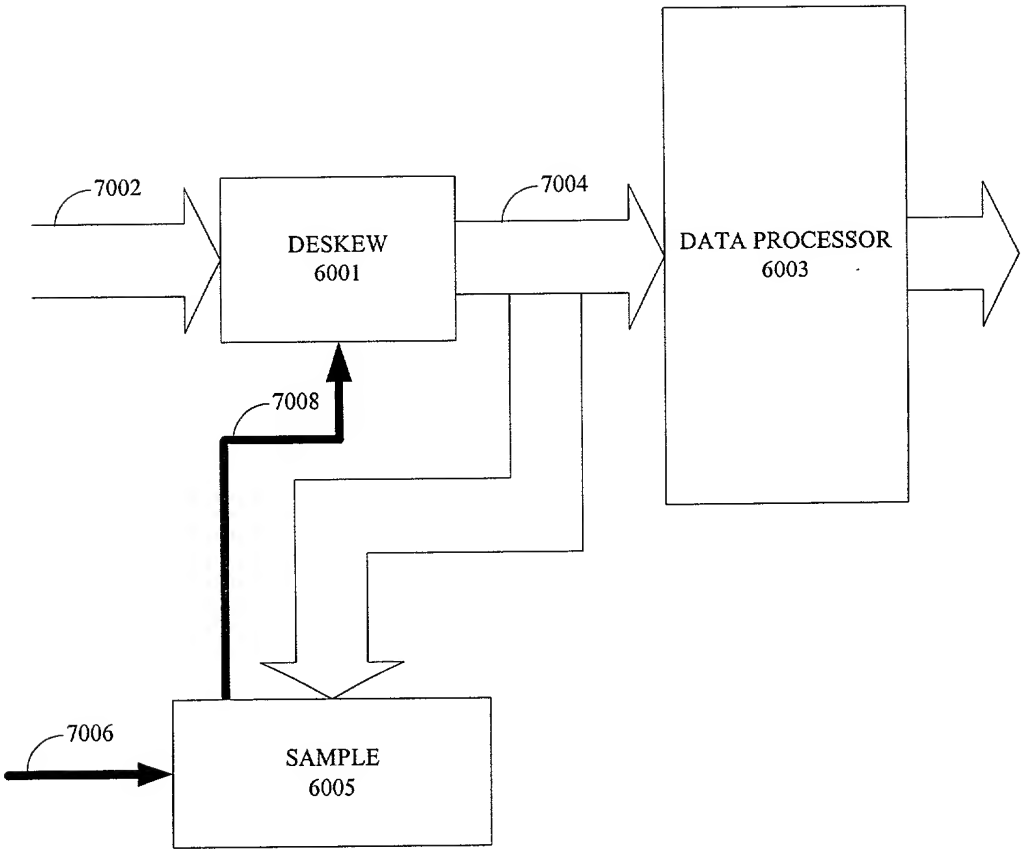

INPUT
DATA
I1
PROCESSOR
3
BUFFER
UNIT
5
DRIVERS
13
SELECTION
UNIT
7
CLOCK
SIGNAL
C1
CLOCK
SOURCE
11
CONTROL
UNIT
9
DATA
SAMPLE
S2

FIG. 6

FIG. 7


7002
DESKEW
6001
7004
DATA PROCESSOR
6003
7008
7006
SAMPLE
6005

PDC-5 Rev 06/06/2006

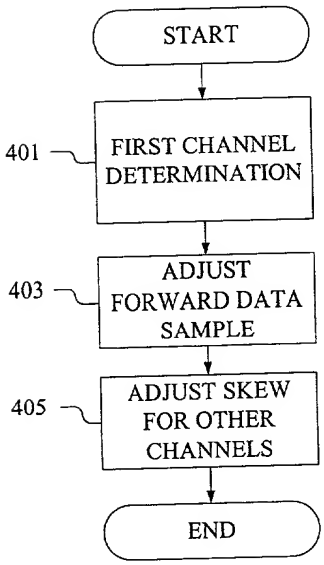


FIG. 8

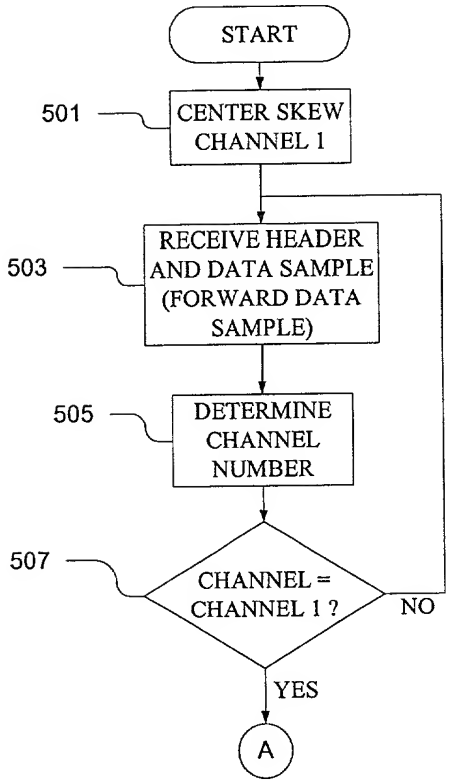

START
501
CENTER SKEW CHANNEL 1
503
RECEIVE HEADER AND DATA SAMPLE (FORWARD DATA SAMPLE)
505
DETERMINE CHANNEL NUMBER
507
CHANNEL = CHANNEL 1 ?
NO
YES
A

FIG. 9

FIG. 10

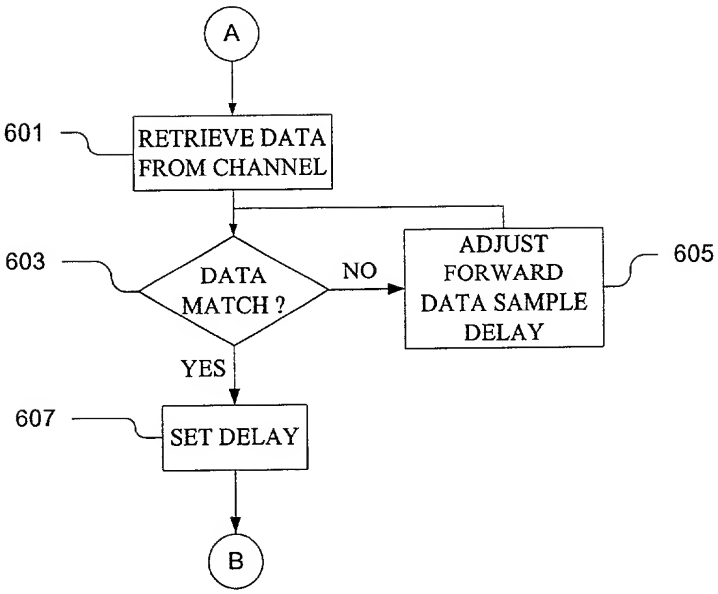

A
601
RETRIEVE DATA FROM CHANNEL
603
DATA MATCH ?
NO
ADJUST FORWARD DATA SAMPLE DELAY
605
YES
607
SET DELAY
B

FIG. 11

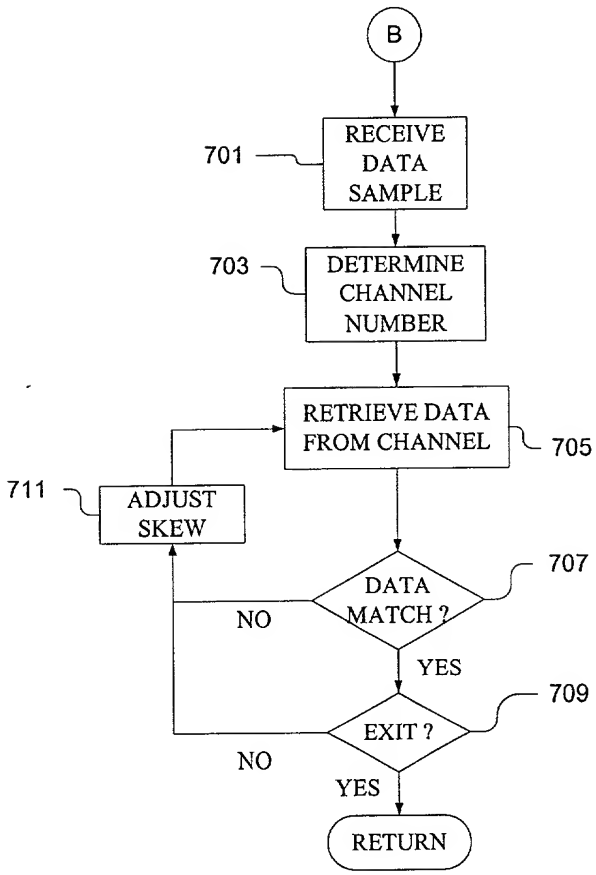
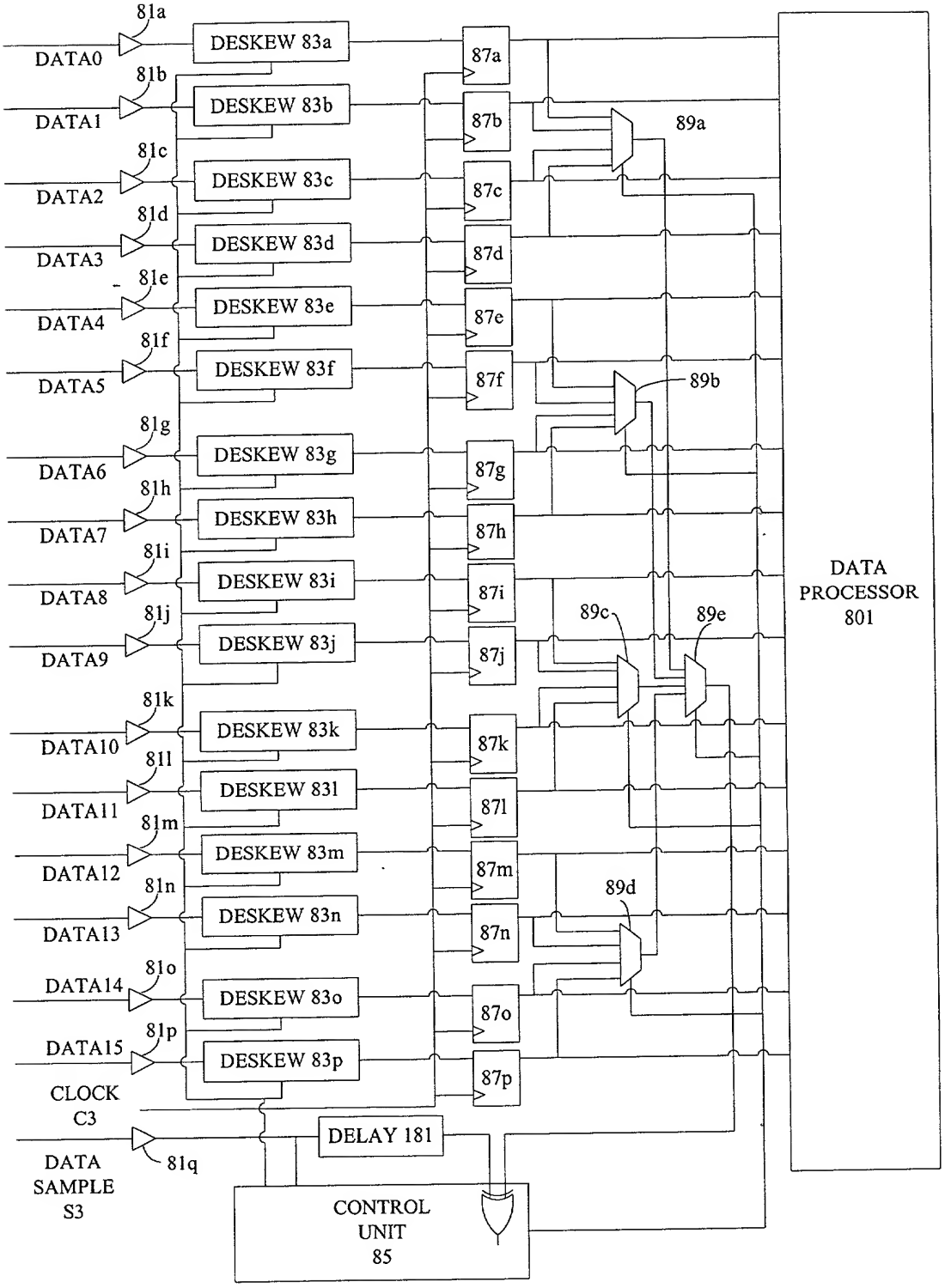

B
701
RECEIVE DATA SAMPLE
703
DETERMINE CHANNEL NUMBER
RETRIEVE DATA FROM CHANNEL
705
711
ADJUST SKEW
707
DATA MATCH ?
NO
YES
709
EXIT ?
NO
YES
RETURN

FIG. 12


81a
DATA0
DESKEW 83a
87a
81b
DATA1
DESKEW 83b
87b
89a
81c
DATA2
DESKEW 83c
87c
81d
DATA3
DESKEW 83d
87d
81e
DATA4
DESKEW 83e
87e
81f
DATA5
DESKEW 83f
87f
89b
81g
DATA6
DESKEW 83g
87g
81h
DATA7
DESKEW 83h
87h
81i
DATA8
DESKEW 83i
87i
89c
89e
81j
DATA9
DESKEW 83j
87j
81k
DATA10
DESKEW 83k
87k
81l
DATA11
DESKEW 83l
87l
81m
DATA12
DESKEW 83m
87m
81n
DATA13
DESKEW 83n
87n
89d
81o
DATA14
DESKEW 83o
87o
81p
DATA15
DESKEW 83p
87p
CLOCK
C3
DELAY 181
81q
DATA
SAMPLE
S3
CONTROL
UNIT
85
DATA
PROCESSOR
801

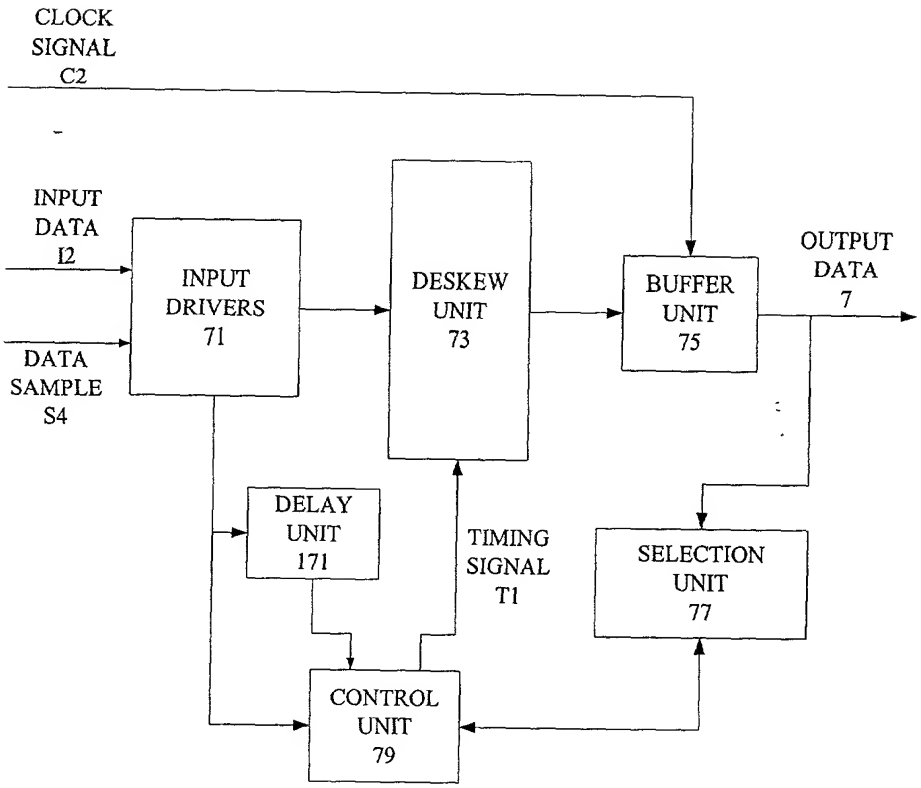

CLOCK SIGNAL C2
INPUT DATA I2
DATA SAMPLE S4
INPUT DRIVERS 71
DESKEW UNIT 73
BUFFER UNIT 75
OUTPUT DATA 7
DELAY UNIT 171
TIMING SIGNAL T1
SELECTION UNIT 77
CONTROL UNIT 79

FIG. 13

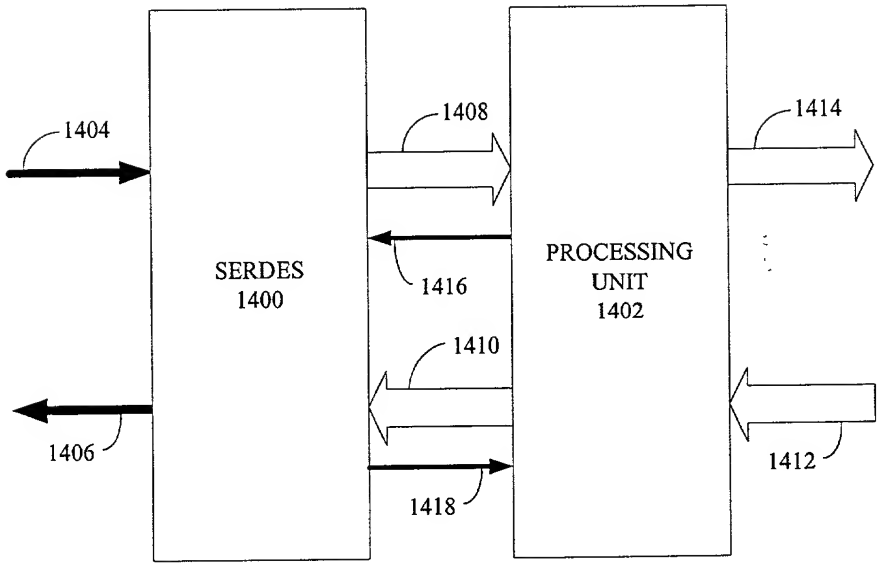

1404
SERDES
1400
1408
1416
1410
1406
1418
PROCESSING
UNIT
1402
1414
1412

FIG. 14A

Express Mail # EL818364612US

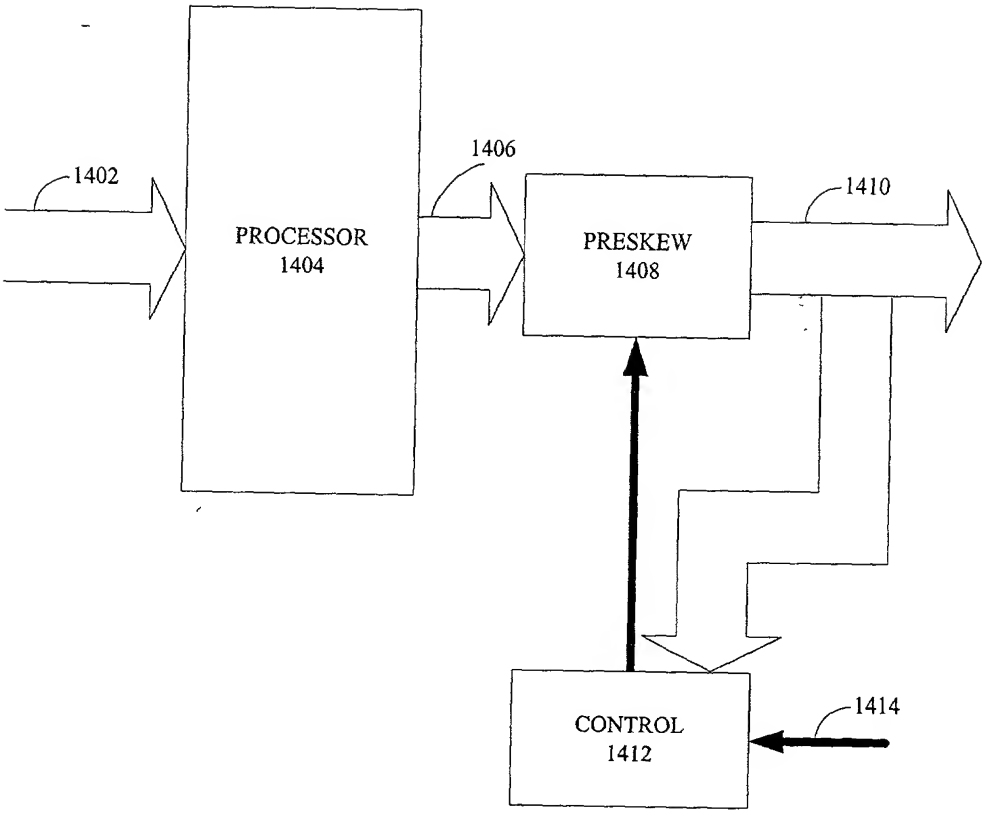


FIG. 14

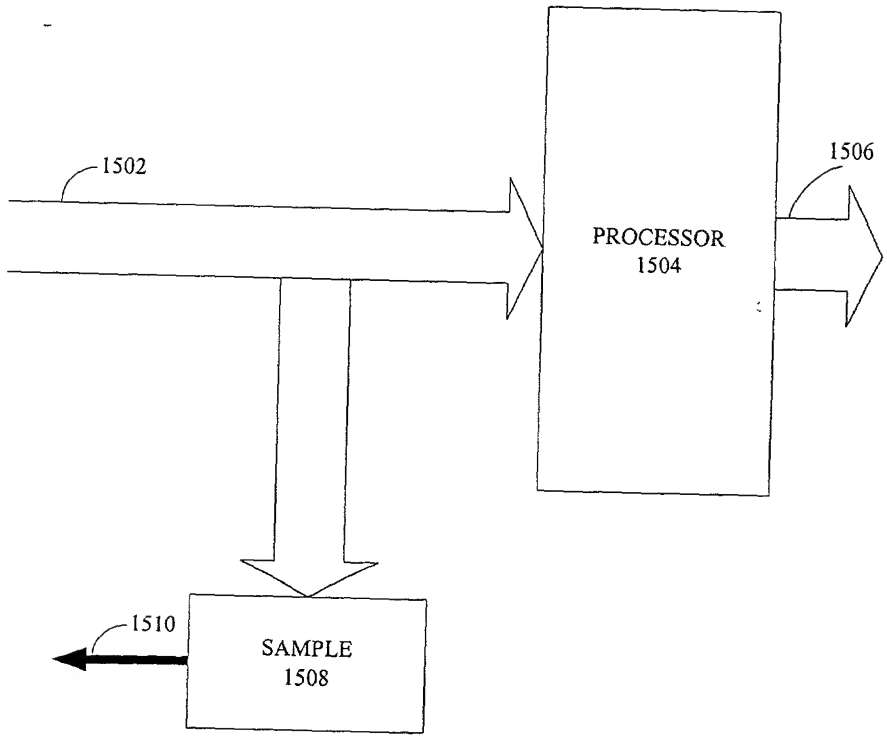


FIG. 15

FIG. 16

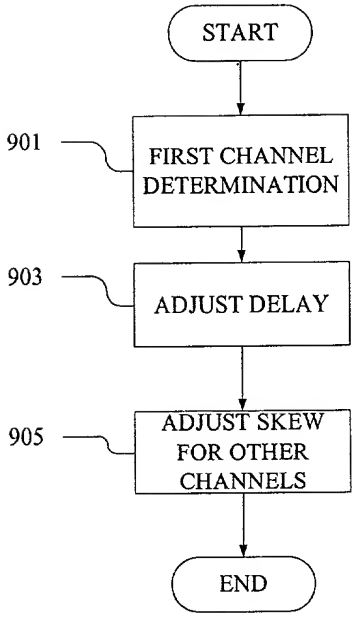

START
901
FIRST CHANNEL DETERMINATION
903
ADJUST DELAY
905
ADJUST SKEW FOR OTHER CHANNELS
END

FIG. 17

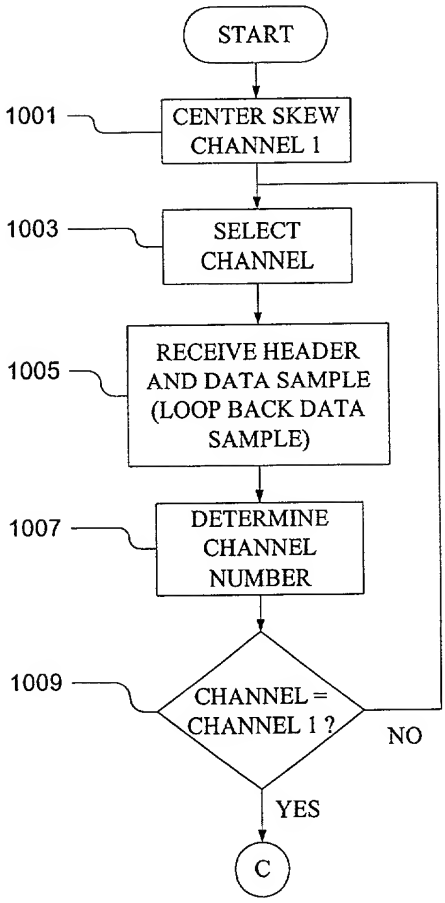

START
1001
CENTER SKEW CHANNEL 1
1003
SELECT CHANNEL
1005
RECEIVE HEADER AND DATA SAMPLE (LOOP BACK DATA SAMPLE)
1007
DETERMINE CHANNEL NUMBER
1009
CHANNEL = CHANNEL 1 ?
NO
YES
C

FIG. 18

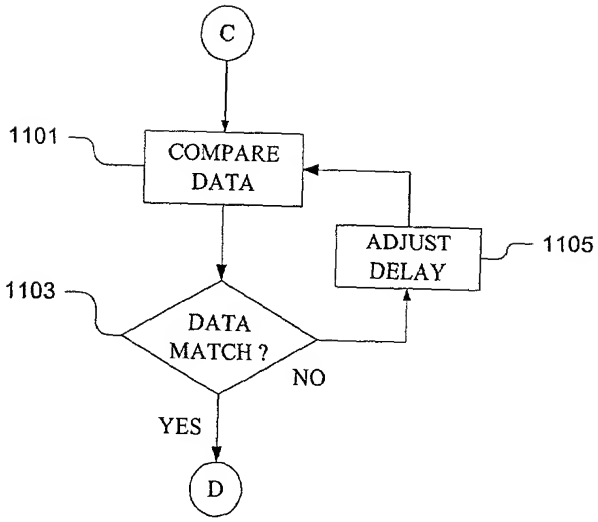

C
1101
COMPARE DATA
ADJUST DELAY
1105
1103
DATA MATCH ?
NO
YES
D

FIG. 19

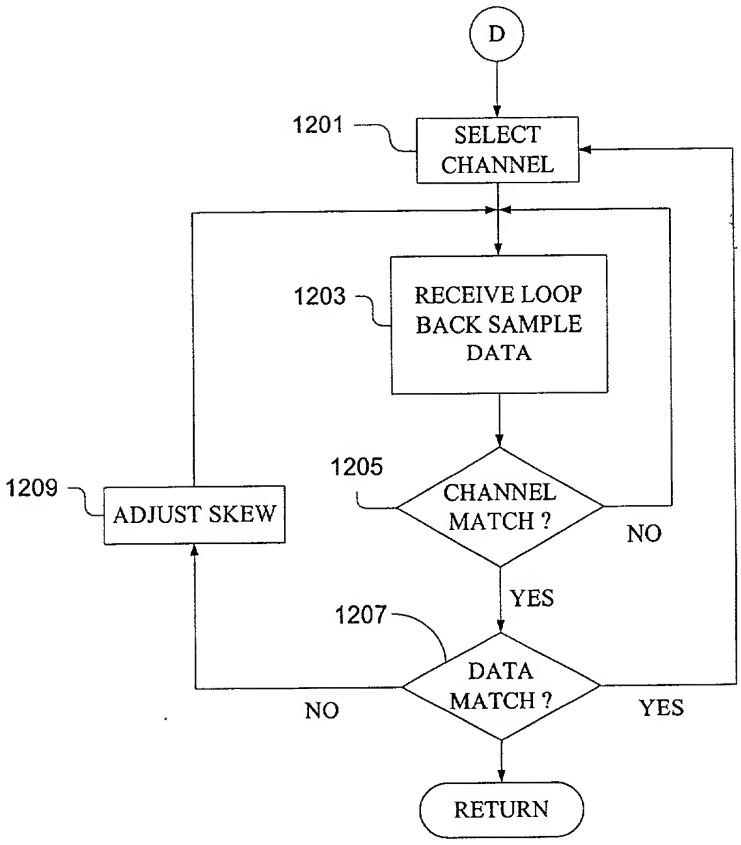
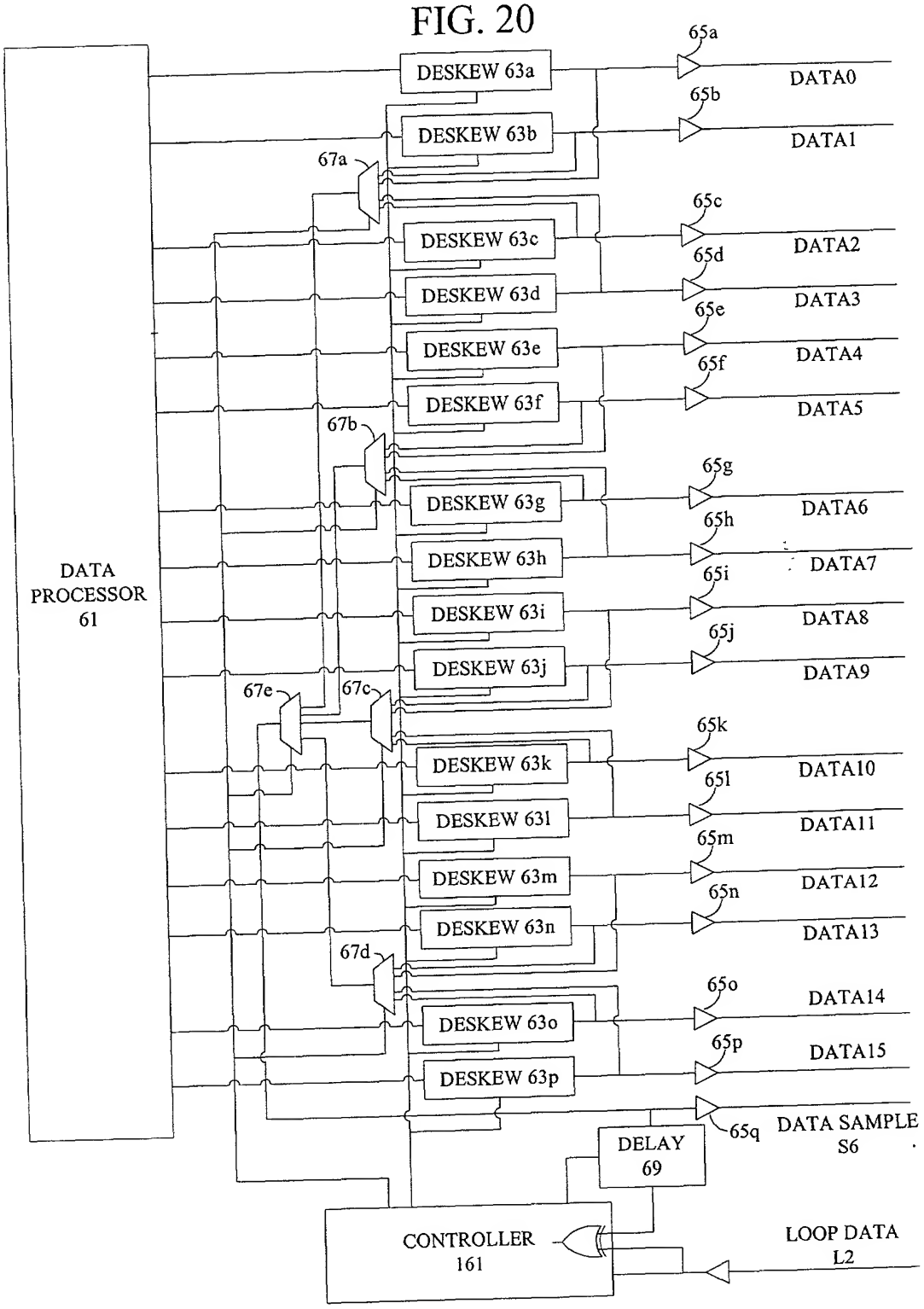

D
1201
SELECT CHANNEL
1203
RECEIVE LOOP BACK SAMPLE DATA
1205
CHANNEL MATCH ?
NO
YES
1207
DATA MATCH ?
NO
YES
1209
ADJUST SKEW
RETURN

FIG. 20


DATA PROCESSOR 61
DESKEW 63a
DESKEW 63b
DESKEW 63c
DESKEW 63d
DESKEW 63e
DESKEW 63f
DESKEW 63g
DESKEW 63h
DESKEW 63i
DESKEW 63j
DESKEW 63k
DESKEW 63l
DESKEW 63m
DESKEW 63n
DESKEW 63o
DESKEW 63p
65a
65b
65c
65d
65e
65f
65g
65h
65i
65j
65k
65l
65m
65n
65o
65p
65q
DATA0
DATA1
DATA2
DATA3
DATA4
DATA5
DATA6
DATA7
DATA8
DATA9
DATA10
DATA11
DATA12
DATA13
DATA14
DATA15
DATA SAMPLE S6
67a
67b
67c
67d
67e
DELAY 69
CONTROLLER 161
LOOP DATA L2

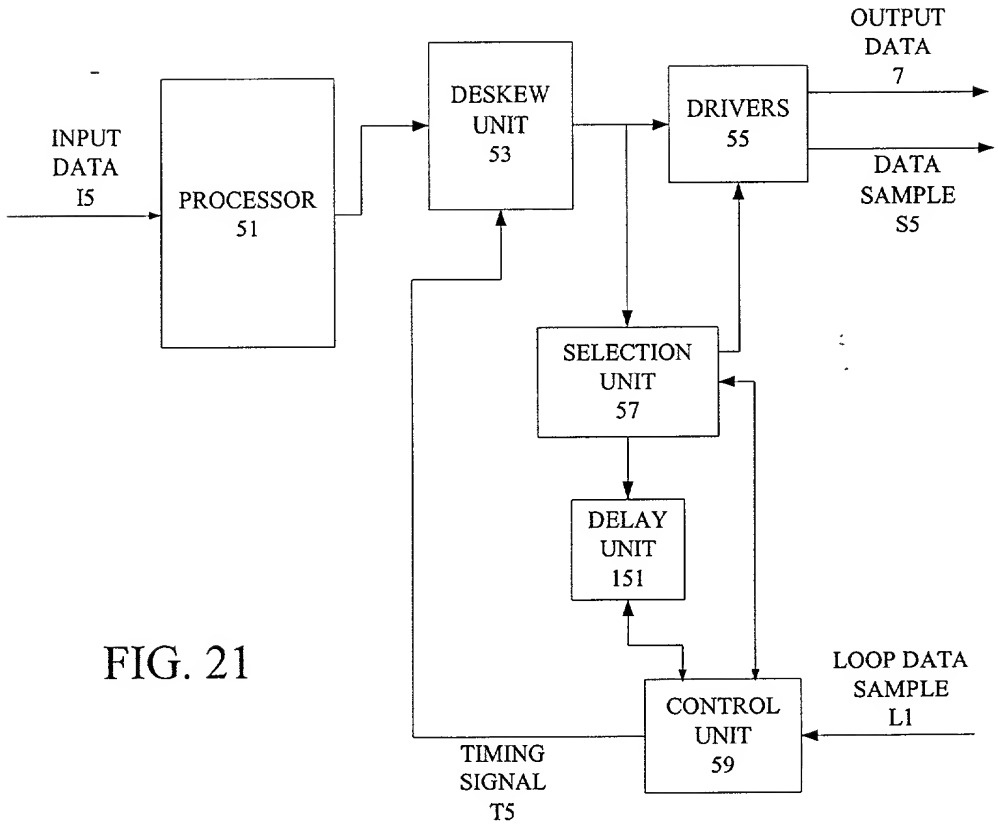
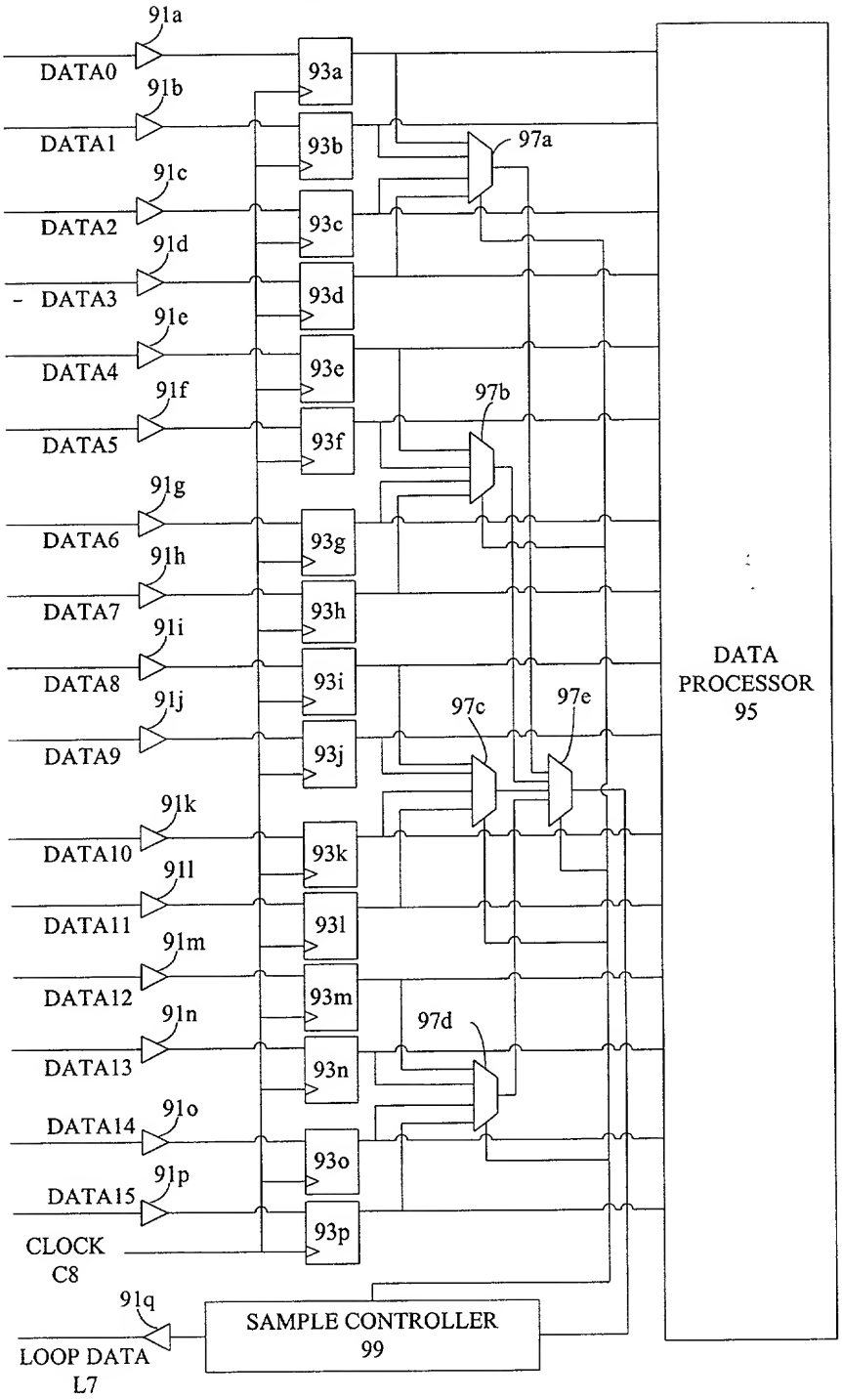

INPUT DATA I5
PROCESSOR 51
DESKEW UNIT 53
DRIVERS 55
OUTPUT DATA 7
DATA SAMPLE S5
SELECTION UNIT 57
DELAY UNIT 151
CONTROL UNIT 59
LOOP DATA SAMPLE L1
TIMING SIGNAL T5

FIG. 21

FIG. 22


91a
DATA0
91b
DATA1
91c
DATA2
91d
DATA3
91e
DATA4
91f
DATA5
91g
DATA6
91h
DATA7
91i
DATA8
91j
DATA9
91k
DATA10
91l
DATA11
91m
DATA12
91n
DATA13
91o
DATA14
91p
DATA15
CLOCK
C8
91q
LOOP DATA
L7
93a
93b
93c
93d
93e
93f
93g
93h
93i
93j
93k
93l
93m
93n
93o
93p
97a
97b
97c
97d
97e
SAMPLE CONTROLLER
99
DATA
PROCESSOR
95

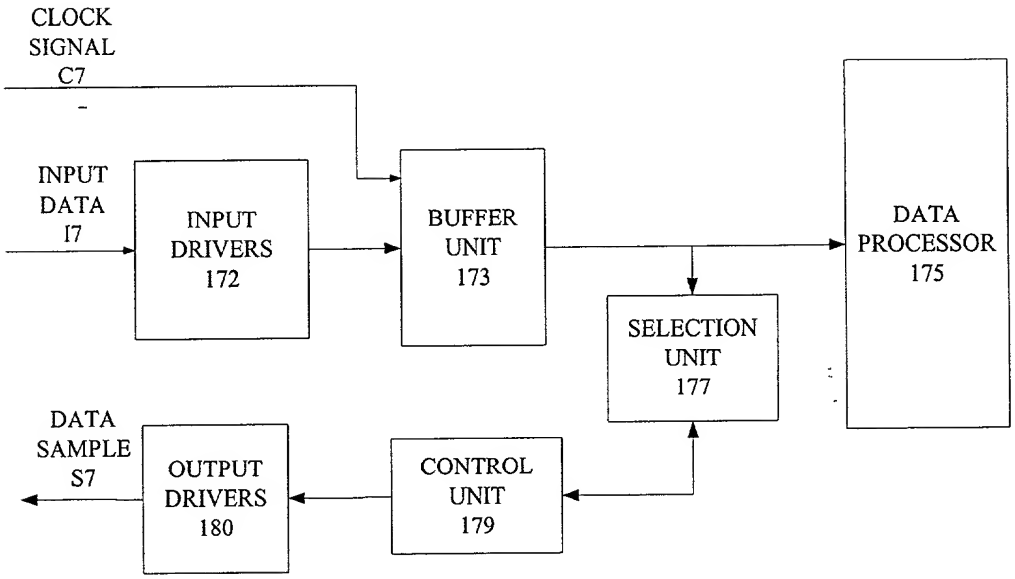

CLOCK SIGNAL C7
INPUT DATA I7
INPUT DRIVERS 172
BUFFER UNIT 173
DATA PROCESSOR 175
SELECTION UNIT 177
DATA SAMPLE S7
OUTPUT DRIVERS 180
CONTROL UNIT 179

FIG. 23

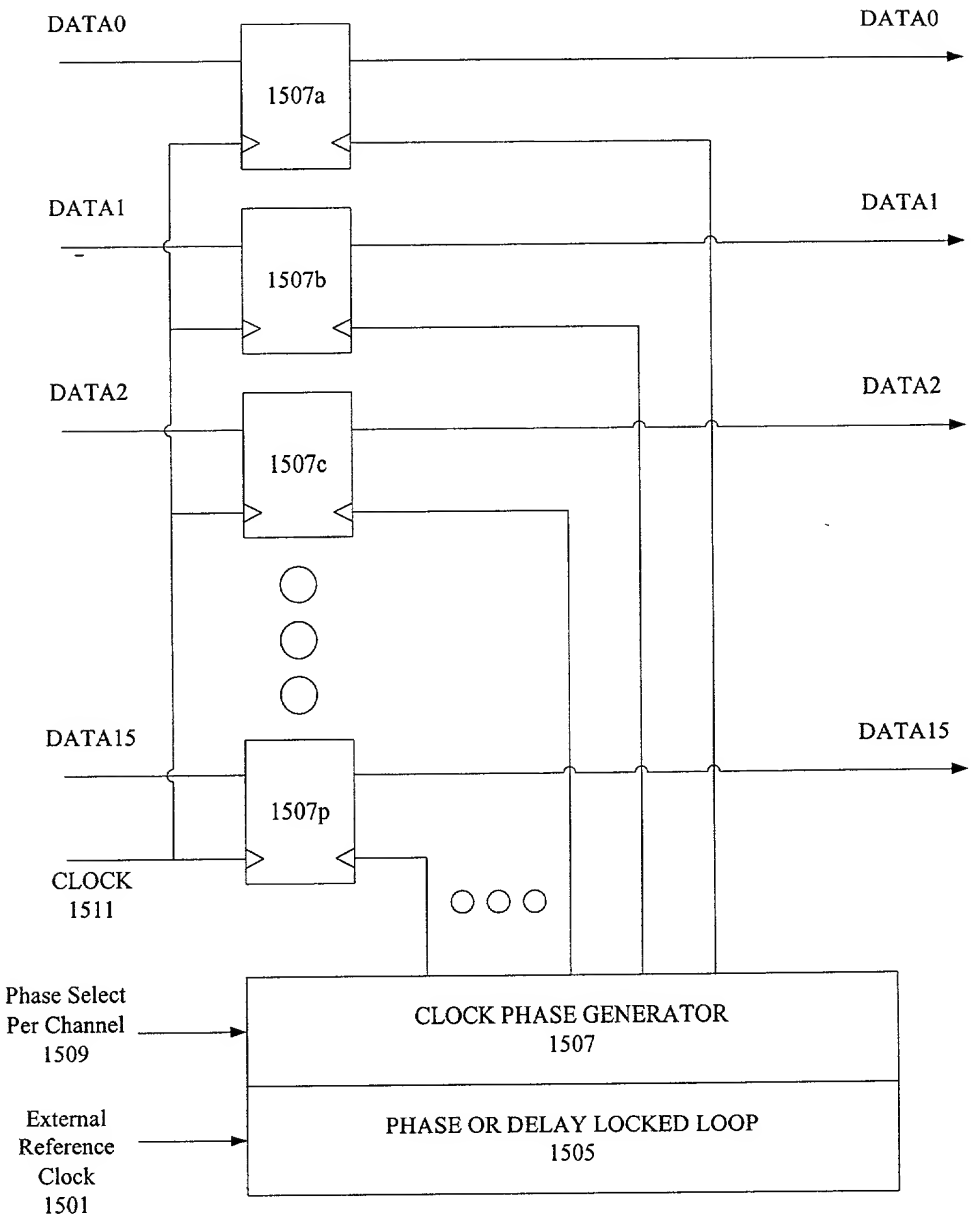

DATA0
DATA0
1507a
DATA1
DATA1
1507b
DATA2
DATA2
1507c
DATA15
DATA15
1507p
CLOCK
1511
Phase Select
Per Channel
1509
CLOCK PHASE GENERATOR
1507
External
Reference
Clock
1501
PHASE OR DELAY LOCKED LOOP
1505

FIG. 24

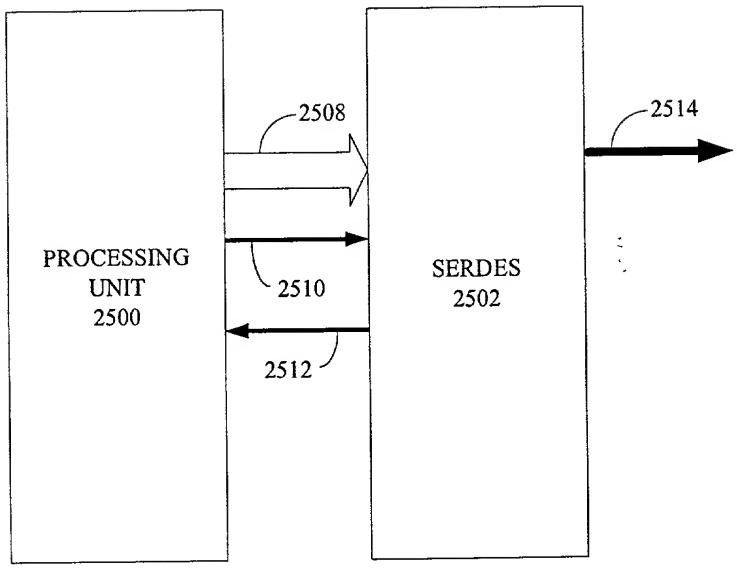


FIG. 25A

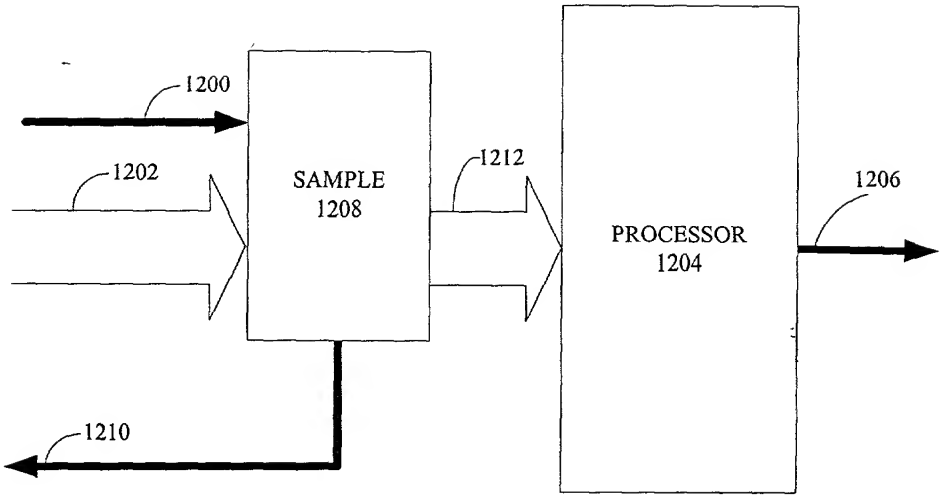


FIG. 25B

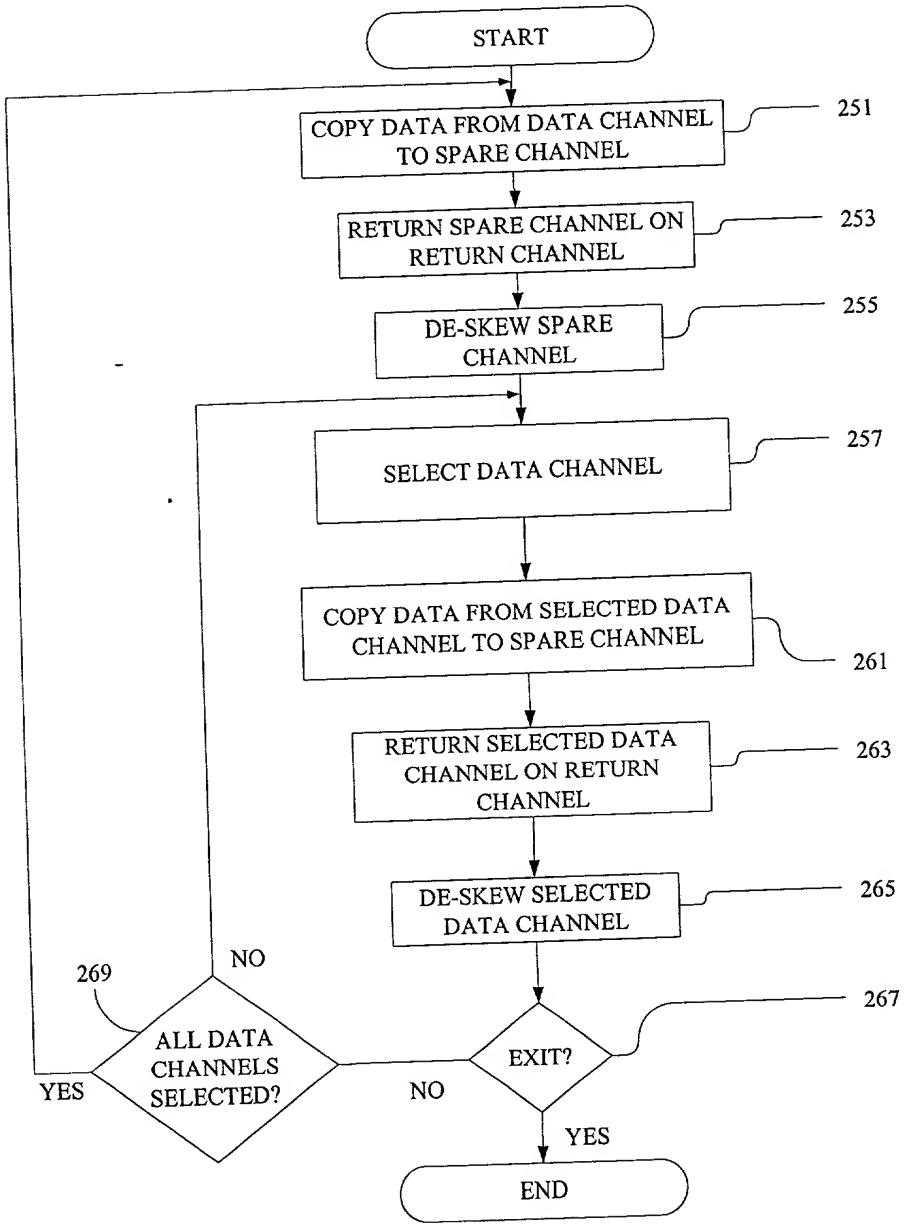

START
COPY DATA FROM DATA CHANNEL TO SPARE CHANNEL
251
RETURN SPARE CHANNEL ON RETURN CHANNEL
253
DE-SKEW SPARE CHANNEL
255
SELECT DATA CHANNEL
257
COPY DATA FROM SELECTED DATA CHANNEL TO SPARE CHANNEL
261
RETURN SELECTED DATA CHANNEL ON RETURN CHANNEL
263
DE-SKEW SELECTED DATA CHANNEL
265
EXIT?
267
NO
YES
ALL DATA CHANNELS SELECTED?
269
NO
YES
END

FIG. 25

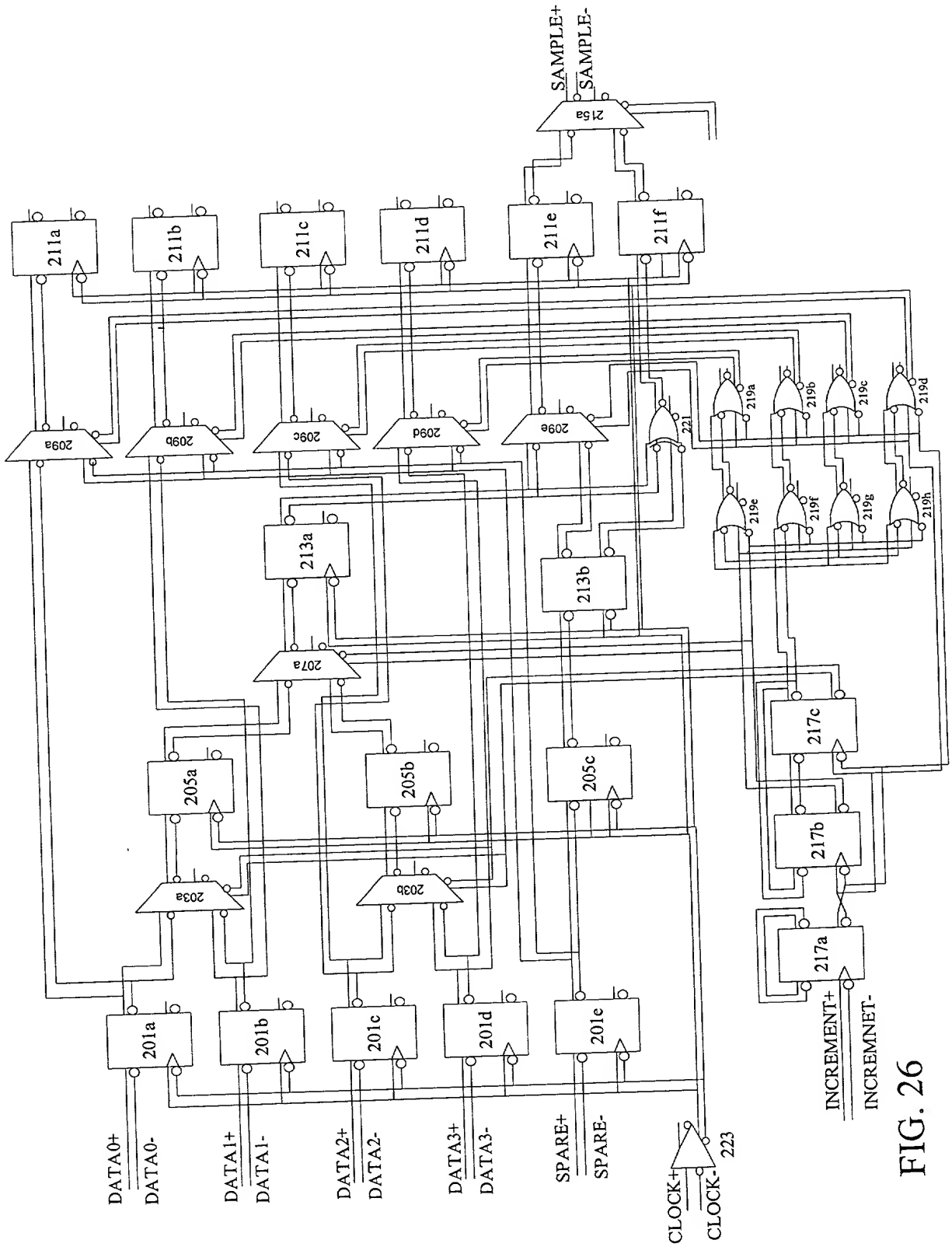
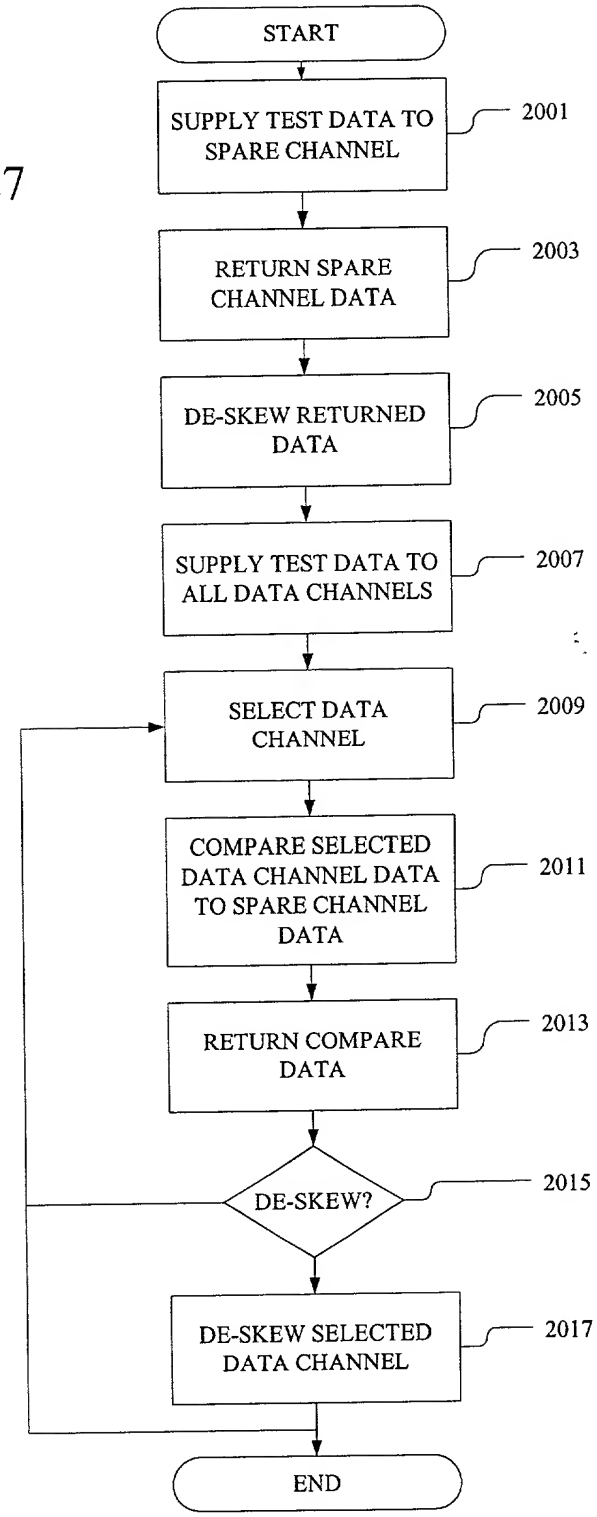

SAMPLE+
SAMPLE-
215a
211a
211b
211c
211d
211e
211f
209a
209b
209c
209d
209e
221
219a
219b
219c
219d
219e
219f
219g
219h
213a
213b
207a
205a
205b
205c
217c
217b
217a
203a
203b
201a
201b
201c
201d
201e
INCREMENT+
INCREMNET-
DATA0+
DATA0-
DATA1+
DATA1-
DATA2+
DATA2-
DATA3+
DATA3-
SPARE+
SPARE-
CLOCK+
CLOCK-
223

FIG. 26

FIG. 27


START
SUPPLY TEST DATA TO SPARE CHANNEL
2001
RETURN SPARE CHANNEL DATA
2003
DE-SKEW RETURNED DATA
2005
SUPPLY TEST DATA TO ALL DATA CHANNELS
2007
SELECT DATA CHANNEL
2009
COMPARE SELECTED DATA CHANNEL DATA TO SPARE CHANNEL DATA
2011
RETURN COMPARE DATA
2013
DE-SKEW?
2015
DE-SKEW SELECTED DATA CHANNEL
2017
END

A1 11110110	A1 11110110	A2 00101000	A2 00101000
CH XXXXXXXX	SL XXXXXXXX	ST0 XXXXXXXX	ST1 XXXXXXXX
D00 XXXXXXXX	D01 XXXXXXXX	D02 XXXXXXXX	D03 XXXXXXXX
D10 XXXXXXXX	D11 XXXXXXXX	D12 XXXXXXXX	D13 XXXXXXXX

FIG. 28

Attorney: Daniel M. Cavanagh
Docket No.: 47545/DMC/165
Inventor(s): Hendrickson, Schmitt, Coe
Title: DATA DE-SKEW METHOD AND SYSTEM
EXPRESS MAIL EL818364612US
Sheet 33 of 33

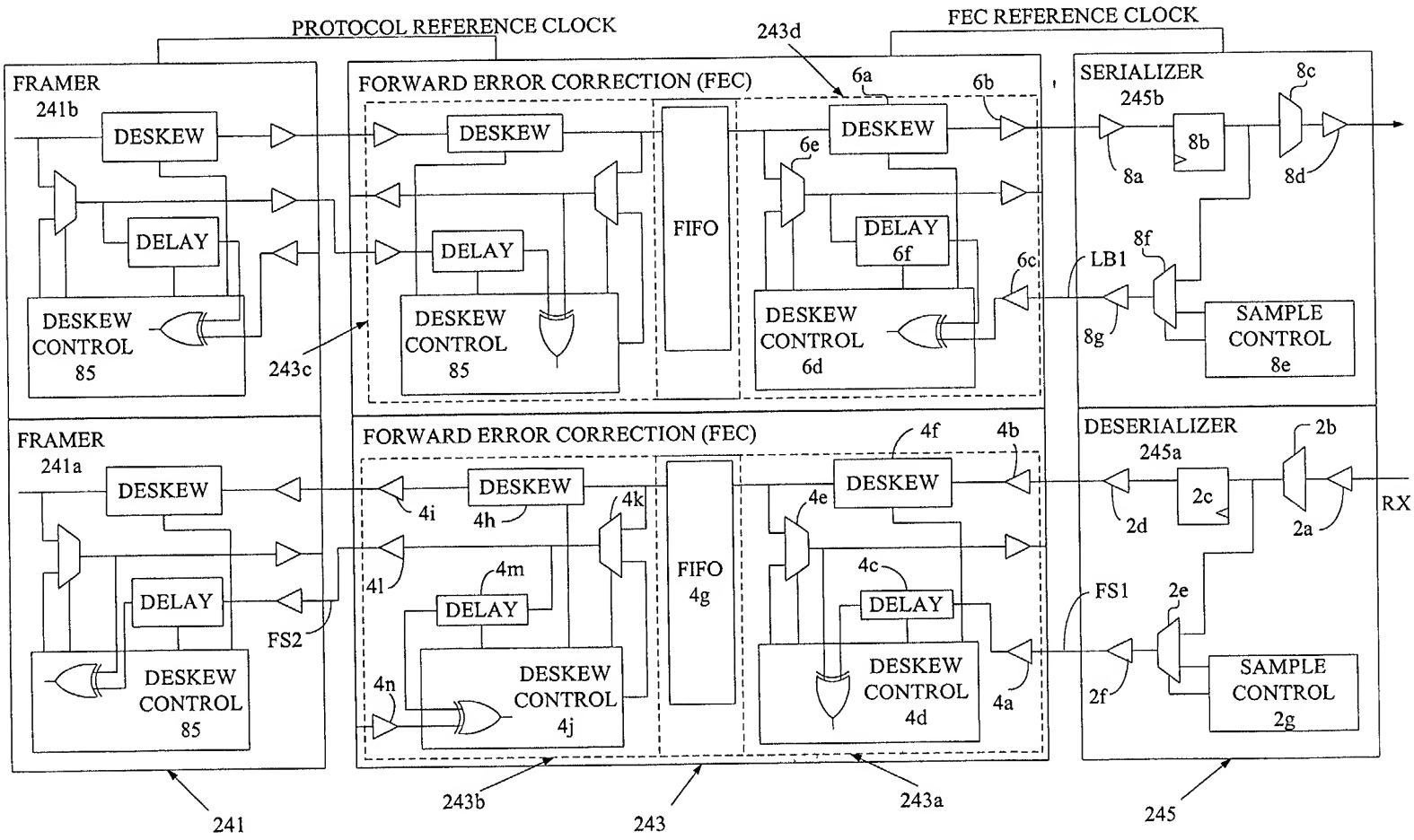


FIG. 29